SECOND ANNUAL CONFERENCE OF THE WOODS DEPARTMENT

BERLIN MILLS COMPANY
BURGESS SULPHITE FIBRE CO.
FITZGERALD LAND & LUMBER CO.
QUEBEC & ST. MAURICE INDUSTRIAL CO.

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HELD AT
GORHAM, NEW HAMPSHIRE
WEDNESDAY NOVEMBER 25th, 1914

Preface.

The Second Annual Conference of the staff of the Woods Department of the Berlin Mills Company and its American and Canadian subsidiaries was held at Gorham, N. H., at the Mount Madison House Wednesday, November 25, 1914. This year's conference proved even more successful through the better acquaintance of the members than the one previous and the papers given were of excellent and practical value.

During the morning all hands rode to the farm of the General Manager for a rifle shoot, pictures of which are given herein as well as the individual scores and a picture of the three prize winners. The undecided question as to the pre-eminence of the American or Canadian team was left to be settled the following year.

At 2 P. M. a turkey dinner was served to the sixty-five members at the Mount Madison House, Mr. D. P. Brown presiding, with bright local stories given by Carter, Cassidy and others. After dinner the papers here printed were read and interesting photographs of scenes in connection with the operations of the various companies were thrown on the screen.

MEMBERS SECOND ANNUAL CONFERENCE
MT. MADISON HOUSE GORHAM, N. H. NOVEMBER 28TH 1914

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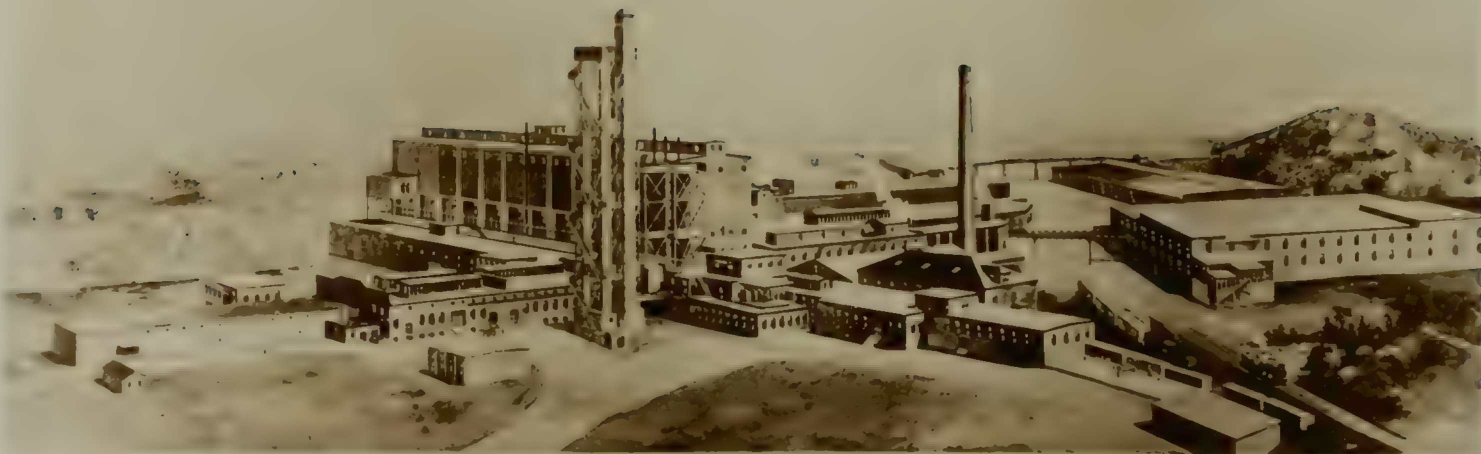

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LA TUQUE QUEBEC CANADA

Applied Forestry.

By S. L. de Carteret.

TO the industries in which we are engaged, the following definition of forestry, given by the Forester of the United States is particularly applicable:

> "Forestry aims to utilize the present product of the forest with the greatest possible economy, and with profit to the owner, and at the same time to provide for the continuance of the forest, and for the production of timber and other forest products in the future."

Forests privately owned or controlled are managed for profit; consequently any scheme of forest management involving the practice of forestry, to be a success must produce returns in one form or another, commensurate with the extra expenditure necessitated by such practice.

These returns are obtainable in the following terms:—

(1) Improved condition of the forest, with increase of productivity.
(2) Increased efficiency in logging.
(3) Prevention of waste.
(4) Prevention of loss by decay, windfall, fire and insect depredations.

The attainment of these results requires:—

(a) A detailed classification of the forest, from which is derived,
(b) A suitable silvicultural system.
(c) Logging budgets carefully planned and executed.
(d) Adequate inspection as operations proceed.
(e) An efficient system of protection from fire.

CLASSIFICATION OF THE FOREST.

With any tract of timberland the primary requisite of any scheme of forest management is a set of topographical maps showing all such natural features as drainage systems, ridges and divides; distribution of timber, type groups, species, amount and size; improvements such as roads, trails, dams, etc.; subsequent changes in the virgin forest such as cuttings, windfalls,

burns, and areas affected by insects; division of the area into logging units, the boundaries of which are based on the natural features of the land. These maps should be supplemented by reports giving the amount of timber on each logging unit, classified according to type groups, species, diameter classes and ages of the various stands found therein.

SILVICULTURAL SYSTEMS.

Silviculture is the art of establishing, developing and reproducing forests, the end in view being to secure quick reproduction of valuable species in fully stocked stands; to produce trees of good form and quality, and to accomplish rapid growth.

Quick reproduction is secured by careful cutting, avoiding injury to young growth as much as possible, and by keeping out fire. Increase in quantity of desirable species is regulated by cutting the less desirable species to a lower diameter limit.

Fully stocked stands are dependent on an abundant distribution of seed, and conditions favorable to germination and early growth. Good form and quality is obtained in mixed rather than pure stands.

There are three general silvicultural systems dependent on reproduction by seed, namely:—

The Selection System.
The Clear-cutting System.
The Shelterwood System.

The Selection System is applicable to tolerant species in uneven aged forests. It is used where market conditions are such that only a limited class of trees can be cut to a profit; also where the removal of medium sized trees would be less profitable than saving them for growth and later cutting.

The principle involved in this system is the development of a number of age classes. The period between cuttings is called the *cutting cycle*, which in this country is from 20 to 50 years, the amount cut being equal to the total growth of one cycle. For the continuous operation of a selection forest two things are necessary, viz: Maintenance of the rate of growth of the whole stand, and a proper representation of age classes. Unless all age classes are normally represented, cuttings cannot be made at regular intervals of an amount of timber equivalent to the full growth of the stand. The aim of the system is to get an equal aggregate in each age class.

In actual operations a diameter limit is generally used instead of an age limit. Diameter limits are determined very largely by guesswork and precedent.

Before a diameter limit can be successfully applied it is necessary to determine what the forest can produce, and at what diameter further growth is no longer sufficiently profitable to the owner.

Cutting to a fixed diameter limit does not take into consideration the condition of trees as to health and growth. In a virgin forest there are many trees below the diameter limit which are old (some as old as the

largest trees in the stand) which will produce little growth or may not survive until the next cutting period. These should be utilized. Others just above the diameter limit, making rapid growth, it would often be good policy to leave. Frequently it is necessary to cut whole groups of trees under the diameter limit to save them from windfall.

Northern Maine is adaptable to the selection system. The tolerant species found in this locality are spruce, hemlock and fir, beech, hard and soft maple. Pine and larch are intolerant species. In some types of forest the hardwoods will crowd out the spruce.

In regions where all the products of the forest have a commercial value and a ready market the clear-cutting and shelterwood systems are used with the result that eventually even aged forests are produced.

The Clear-cutting System is used where there is danger of windfall after a heavy thinning. Also where all the trees are large and mature; where undesirable species are to be eliminated and where a clearing is necessary for the natural reproduction of intolerant species.

Very often a thinning light enough to prevent windfall would not pay and consequently clear cutting is necessary.

There are several disadvantages attendant to clear cutting such as erosion on slopes, deterioration of soil, growth of brush, grass and weeds which compete with young tree growth, exposure of young trees to drying by sun and wind and damage by frost and insects. These disadvantages can be largely eliminated by cutting in small patches or narrow strips.

Reproduction after clear cutting is obtained either by natural or artificial means or by both, artificial means being used in the latter case in areas incompletely stocked. For natural reproduction thrifty, fullcrowned, windfirm seed trees should be chosen. Seed trees should not stand farther apart than their average height, the average number per acre for good reproduction being from 5 to 10 trees. Small trees are as satisfactory as large trees provided they have full thrifty crowns.

The Shelterwood System is particularly applicable to trees bearing heavy seed and is used where most of the trees are mature and windfirm. The underlying principal is the gradual removal of a stand by a system of thinnings. In this country there are generally only two cuttings, the first being called the seed cutting and the second, which occurs from 10 to 20 years later is called the final cutting.

The advantages of the system are several. A large number of seed trees comparatively close together are distributing quantities of seed at regular intervals. The shade of the standing trees retards the growth of brush, weeds and grass, and the seedlings are protected from drying and frost. A new stand is established in advance of the final cutting and during the reproduction period the standing trees are gaining their maximum growth.

No one system will apply to the whole or even the greater part of our timberlands. The local conditions of each region, coupled with marketing

possibilities are the determining factors in choosing suitable silvicultural systems.

LOGGING BUDGETS.

Having decided on the method of cutting to be followed in a given logging unit, tentative working plans are then commenced, at which time the detailed classification of the forest is of inestimable value.

By way of parenthesis, it is not to be inferred that a detailed collection of data on the forest conditions of the tract precludes the necessity of further work in the field previous to locating contractors. The cruising of job locations by woods superintendents and logging bosses is as necessary as ever, but without doubt this work can be done more easily, quickly and efficiently where there is carefully compiled information to draw upon.

The all important consideration in converting standing timber into logs, pulpwood or other forest products is cost delivered. Items affecting this figure are transportatian of supplies, size, density and condition of timber, length of haul, ground, chance to drive.

In any section of unbroken forest, topographical maps show the possible routes for roads from one point to another and give a general idea of the obstacles to be overcome such as heavy grades over divides, swamps to be circumvented or crossed, streams and rivers to be bridged.

On any given watershed the ultimate aim is to make all the merchantable tributary timber coming within the limits prescribed by the method of cutting adapted. This means, cutting back to the rear boundaries which are generally watershed lines. Very often in letting contracts the rear boundary of the job is supposed to be a watershed line but if the area and amount of timber included is too large for the amount of the contract, the less accessible timber, which generally lies near the height of land, will in all probability be left. To avoid this, the merchantable area of the contracted territory must be known as well as the amount of timber above the cutting limit. To avoid timber being left due to discrepancies in estimating, contracts should call for the cutting of *all timber* of kinds and sizes specified in the contract that may be found on the territory. This necessitates laying out definite boundaries on the ground for each contract.

When it is planned not to cut back to the natural boundary of the watershed care should be taken to leave sufficient timber between the rear of the contracted area and the natural boundary of the watershed, to warrant the balance of the timber being taken out at some later time without too great an increase of contract price.

These two precautions tend to lessen the average cost of the total amount of timber cut on the tract, and the requisite information for doing so can be ascertained with a considerable degree of accuracy from topographic and forest maps.

Detail maps show the density and composition of stands, approximate length of haul, general nature of country as to whether it is steep, rolling or nearly flat. These items are all of material value in approximating jobbing prices. In making extensive river improvements the amount expended is

governed by the amount of timber to be handled. This figure is obtained from the timber estimates of the watershed in question. In making storage reservoirs for driving it is often important to know the areas of storage and drainage. This information is also accessible in the maps. Some mills can only use certain species of trees. The percentage of species for any part of a watershed can be obtained from the estimates, and cutting can be regulated accordingly if necessary.

INSPECTION.

Permanency of supply of raw material is largely dependent on close utilization. In lumbering, unless waste is particularly guarded against, a large percentage of the raw material is a total loss.

Sources of waste are high stumps, large tops, broken and lodged trees, merchantable trees left standing, logs cut and left in the woods, use of valuable species for building camps, bridges and skidways, cutting of trees under the diameter limit which should be left for future growth, damage to young growth, use of axes instead of saws.

Printed regulations regarding cutting and waste, and schedule of fines for infringements, should be posted in each camp before cutting starts, and in other prominent places such as Company storehouses, scalers' camps and offices.

Inspection should begin with the commencement of cutting and continued until the finish of hauling. It should be conducted independently of the scaling by men who have no other duties to draw on their time. Written reports should be made on each cutting section of each contract, showing in definite figures the amount of waste under each heading. Reports should be followed up regularly to see that waste is eliminated. The contractor should be told at once of the result of each inspection and wherein work is lacking. Inspection reports should be filed for reference and for computing fines and a duplicate copy kept by the inspector to be used in his subsequent inspections in making comparisons with previous work. A schedule of fines, rigidly enforced, coupled with continuous inspection is the best preventative of waste.

Where competent inspection is not carried on 25 to 30 per cent waste, in terms of the total amount cut and delivered, is not uncommon. With the ordinary run of contractors, competent inspection can easily reduce this figure to from 3 to 5 per cent and generally less.

PROTECTION FROM FIRE.

The greatest menace to standing timber is fire and the first essential for the success of any scheme of forest management is adequate protection from fire.

Any specific tract is menaced by fires from two general sources, viz: those commencing outside, and those originating within the tract.

The first demands systematic patrols covering large groups of holdings, irrespective of ownership, with adequate facilities for fighting fire.

The second requires an organization on each tract under operation able to cope with the hazards created in the actual process of logging. As protection from fire is being treated in another paper in detail, reference to precautions to be taken in logging will be referred to only.

A tract which has been logged over generally presents better facilities for travel and patrol than an area of untouched forest. The danger of fire. however, is increased many times by slashing, over that in standing timber, Consequently it is only equitable that a logging operation should help minimize the extra hazard it creates. This is possible by slash disposal and segregation of cut-over areas.

There are four general methods of slash disposal:

(1) Piling and burning as logging proceeds.
(2) Piling and burning at separate intervals.
(3) Lopping tops.
(4) Broadcast burning.

The method of piling and burning as logging proceeds is used where cutting is done after the first snow or in wet weather, when there is no danger of fire spreading. Small fires are started by each cutting crew and the branches thrown on as they are trimmed off.

Piling and burning in different operations is done where cutting is done in dry weather and it is not safe to burn. It generally requires an extra man to each cutting crew. Piles should be made not more than 10 feet across by 6 feet high and should not be closer than 15 feet to any standing trees. The butt ends of branches should be placed toward the center of the piles. Burning is done when there is no wind, after the first snow or in wet weather.

Lopping tops is the method used in moist regions, where there is little danger of fire. Also where the stand is so dense that burning is impossible without damage to standing timber. Also where utilization is such that there is but little crown left.

Broadcast burning is only applicable where clear-cutting is done and where litter and debris is a detriment to reproduction. In the use of this method any young growth already on the ground is invaribly killed.

In our coniferous forests there is a big fire hazard due to the dry periods occuring almost every summer, and the large amount of debris from tops and bark, especially in cuttings in stands of small timber. Piling and burning over the entire area cut is impracticable. Segregation of each season's slash from the surrounding timber seems to be the most reasonable solution. This segregation is possible by the clear-cutting of a strip 50 to 100 feet wide on the inside of the marked boundary of each area contracted, accompanied by disposal, by piling and burning of the debris in the strip including all unmerchantable growth. In this way each season's slash, on each job, would be segregated from the surrounding forest and also from the previous season's slashings. This could be accomplished during the cutting operations at a small additional expense. While crown fires would jump this space under a high wind the cleared strip would give a good base for stopping surface fires and fighting fires in general.

SKETCH OF A HYPOTHETICAL VALLEY

SHOWING

CONTOUR OF GROUND AND LOCATED IMPROVEMENTS

SKETCH OF A HYPOTHETICAL VALLEY
SHOWING
DIVISION INTO TYPE CLASSES
1" = 80 RODS

Logging Plan for a Hypothetical Valley.

By S. S. Lockyer.

EXISTING VALLEY.

THE Hypothetical Valley used in connection with this consideration of a Logging Plan is assumed to be a piece of timber land in the Northern part of Maine, based on a valley really existing with the interior details somewhat modified. The area is understood to be surveyed for boundaries and one mile block section lines, with reliable outline maps available.

PURPOSE OF LOGGING PLAN.

The purpose and scope of a logging plan is understood to be a representation and recording of existing forest conditions as found on a certain timbered area; the relation of such conditions to lumbering operations, and recommendations for a comprehensive handling of merchantable logs and growing timber.

DIVISIONS OF PLAN.

The delineating or putting together of the facts and data required for such a plan comes under three distinct divisions of thought.

First: Sketches or maps showing the outline; the general contour; and the location of all topographical features which may have a bearing on logging operations and the present or future growing condition of the trees.

Second: Descriptive reports in which is taken up in detail all points shown on the sketches, together with recommendations, suggestions and general observations.

Third: Estimates and computations in tabulated form showing areas, distances, improvements, amounts and cost.

METHOD OF COLLECTING DATA.

The collecting of data for the three different divisions of the logging plan requires but one operation in the field, and may be carried on by one party at the same time, with a distinction as to the three classes of notes.

The devising of a method by which sufficient data may be collected in the field, and intelligently handled in the office, requires careful attention, as there is at present no definite system by which this class of work may be carried on, leaving much to the personal judgment of the party in the field work.

In this connection two points stand out as being essential:

First: A clear understanding as to the ultimate purpose for which the plan is to be used, so that the work can be carried on with one definite point in view.

Second: The make-up of the party which should have certain definite requirements, as a good general understanding for woodland surveying; an accurate knowledge of woodland mapping and reports; timber estimating; the conducting of logging and driving operations in all of their phases; and a thorough knowledge of camping and cooking in the open.

The number of members in the party is immaterial. As long as the necessary knowledge is present, the sketches, reports and estimates will follow simply and logically.

DATA REQUIRED.

For our present purpose of following out a method for the collecting and compiling of data for a logging plan, we will assume that instructions have been issued for the making and developing of a plan for the Hypothetical Valley, to determine the following conditions:

First: To ascertain the area, condition of ground, accessibility and a general consideration of the timber; its present condition, rate of growth, how and when the different classes could be handled most advantageously.

Second: Logging conditions as to the kind and amount of soft wood logs; location of topography, roads, camps, etc., with recommendations for the conducting of operations.

Third: The location of all streams, their drivable length with a distinction for long and short logs, dams, improvements, etc., with a consideration of their tributary conditions.

Fourth: Consideration of fire protection and other damages; together with such recommendations for the general management of the tract as may present themselves.

SURVEYING CREW REQUIRED.

Having considered briefly the purpose of the plan, our next step would be the collecting of data by field work, for which we would assume a crew of three men.

First: The so-called mapper, who is familiar with woodland surveying, reports, map making, timber estimating, study of tree growth, and woodland management.

Second: An experienced woodsman with reliable knowledge of timber estimating, operating and driving, who is also familiar with the Hypothetical Valley region.

Third: Camp cook or man of general work, who understands outdoor camping under all conditions.

EQUIPMENT FOR SURVEYING CREW.

The crew equipment consisting of a small surveyors compass, two hand or pocket compasses, a two rod steel tape, two Aneroid barometers, two pocket thermometers, one combined light diameter and Blodgett caliper rule, one Faustman height instrument, one increment borer, one hand level, note book, paper, pencils, six inch pocket scale, triangle, protractor and pocket Kodak.

CAMPING OUTFIT

The amount and kind of camping outfit will depend materially upon the time of the year when the work is done. For Summer and early Fall work, an outfit would well be made up of a light Baker tent, light sleeping bag per man, a complete aluminum cooking outfit for three men, and one light axe for each member of the party.

Provisions consisting as follows:

Prepared Flour	Milk
Bacon	Tea
Sugar	Coffee
Salt Pork	Salt
Dried Beans	Pepper
Dried Fruit	Potatoes
Butter	Fresh Meat (when possible)
Molasses	Spices

DIVISION OF WORK FOR SURVEYING CREW.

On establishment of camp at a convenient point, a division of work is made. The cook sees that the supply of food is maintained, the camp kept comfortable, and the periodical reading of camp Aneroid during the day when necessary. The other two members of the party give their entire attention to the collecting and keeping of data.

SYSTEM OF TRAVEL.

The fact that besides securing a thorough knowledge of the forest and operating conditions, the mapper must be able to locate certain points and features on sketches and maps, makes it necessary that some system of travel be followed, even though it is subject to variation according to the judgment of the party. For our present work the use of a line and plot system will allow the locating of desired features, and at the same time give a thorough knowledge of the forest and operating conditions. In detail such a system would be to start at some known point, say on the Southern height of land at the intersection of the one mile section line, travel Northerly

along the line, taking sufficient locating notes, elevation readings by the Aneroid barometer and laying off periodical test plots to the height of land on the North side of the valley, where a right angle should be laid off and a hand compass line run one-half mile in length to a point, from which the Northerly height is tied in and a hand compass run parallel to the section line already used back to the Southern height of land. This method of travel to be followed until the entire valley has been covered. If, at any time it is felt that a representative type of area is not being obtained, additional lines of travel may be laid out.

HAND COMPASS LINES, PACING AND DISTANCE.

The method of locating direction by hand compass lines and distances by pacing is not generally understood and its reliability apt to be questioned. However, its cheapness and speed with a sufficient accuracy for general woods work, recommends the using of this method in the making up of a logging plan of this kind, and should be carefully considered before other more expensive methods are used.

The hand compass with a 1½ to 2 inch needle carefully handled may be used in running short lines not over one mile in length with a variation from one to two degrees. Several miles of such line may be run in a day, but if frequent checks are not made on known points, the per cent of accuracy is materially decreased.

Pacing with its adaptibility of being applied to all kinds of travel, compares very favorably with hurried, rough woods chainage when given sufficient care and consideration as to the variation of stride and the keeping of tally under various conditions. Such conditions would be: going up or down hill, roughness or smoothness of the ground, physical condition, speed of travel.

Much will depend upon a systematic method of keeping account of the strides or paces under all conditions. By a careful consideration of these conditions, short lines about one mile in length may be measured with an error not usually greater than 5 per cent.

IMPORTANCE OF NOTE TAKING.

The importance of note taking and making cannot be over estimated, for upon the notes depend the entire foundation of the plan. Important points which are clear and simple in the field become hazy and at times totally lost if not made plain in the notes. Too many clear notes cannot be taken, but much reliability may be lost by poorly made or incomplete notes. Accompanying sketches of outlines and the position of features are of great value in the mapping or compiling of notes of this kind. For example, a sketch of the general outline of the whole or part of the valley gained from some prominent height, by means of the compass and estimated distances adds to the reality of the valley's outline on the map, even though elevations are taken and the height of land tied in at each half mile. Simplicity, clearness and accuracy are the main requirements for all notes in this work.

The notes divide themselves into two classes—1st: The locating of topography and features relating to logging operating. 2nd: The recording of elevations by Aneroid readings, estimates and observations as to the condition of tree growth, together with such other items as may present themselves.

LOCATING NOTES.

The location notes apply to boundaries, types of tree growth, test plots, character of bottom, existing or available roads, trails, camps, telephone lines, etc.; streams, drivable length with a distinction for long and short logs, dams, improvements etc. A certain amount of recording data may be kept in conjunction with the locating notes, such as Aneroid reading, general observation, with such sketches as may be thought necessary for a clear understanding of conditions.

For such notes two styles of sheets are necessary, the first being ruled into three columns for direction, distance and explanation; the second into small squares similar to the squares used on co-ordinate paper for sketching. These sheets to be used on the left and right hand sides in the note book respectively.

The writing of the notes depend materially upon the characteristics of the note taker.

RECORDING NOTES.

The recording notes have to do with estimates and the test plots, which are used as a check on eye estimates and the study of tree growth, so arranged so as to be readily understood for computation.

In detail such notes would consist of—1st: Party, date, line, size and number of plot. 2nd: Kind, condition and number of trees on plot based on breast high diameter. 3rd: Eye estimates for the different kinds of merchantable trees. 4th: Test scale by the Blodgett caliper rule of a certain number of available trees and total heights. 5th: Notes as to the condition growth, character of bottom, slope and aspect.

The make-up of sheets for the use of persons not perfectly familiar with the method of making recording notes, would be well in outline form on the ordinary size note book sheets, so that a systematic and constant form of notes may be had.

A loose leaf note book with stiff covers holding sheets 4x6" in which the various kinds of note sheets can be inserted as required, is well adapted for both locating and recording notes.

COLLECTING DATA.

Having considered at some length the taking of notes, our next step would be the collecting of data for the making up of the notes, and separates itself into locating and recording data, which later is to be used for the sketches, descriptive reports and estimates.

LOCATION DATA.

Location data is usually taken by the mapper who notes down located points or suggestions made by either member of the party, while the lumberman sees to the following of the spotted line or the running of a hand compass line, as the case may be. Such data has to do, not only with the locating of points, but also a certain amount of explanation, which will make plain conditions surrounding the located features, so that as little as possible will be left to the memory when the notes are put into report form.

In detail such a systematic collection of data would be along the following line:

First—The locating of distinct changes in tree growth and topography of land; as soft wood, mixed soft and hard wood, hard wood growth, with reference to the predominating kind of tree, and the accessibility of the ground upon which different types of tree growth stands. Upon such a division depends a knowledge of the growth of standing trees, with the methods and cost for handling logs under various conditions, which should be covered sufficiently in the notes to allow later a division into as many types as might be necessary based on the tree growth, method and cost of operating.

Second—The locating of streams with explanation as to their size, banks, stream bed and tributary conditions. The traveling along the stream bed of all drivable streams for the locating of necessary improvements, dams, etc. If a large amount of timber is to be driven down any particular stream, a carefully located traverse with transit and stadis rods may be well used to get at the possibilities of certain kinds of improvements and dams more accurately.

Third—The locating of existing and possible operating improvements, such as camps, various classes of roads, with a consideration as to the adaptability of the various methods which may be applied to the region, cost, etc.

Fourth—The locating of elevations by Aneroid barometer. Elevations obtained by this method are open to various sources of error, as to changes in temperature, weather conditions, the variation of different instruments and susceptibility to improper handling. These errors may, however, be eliminated sufficiently for ordinary woods work. A convenient method for the securing of fairly reliable Aneroid readings is by using a camp Aneroid and thermometer in conjunction with the readings taken in the field, that is, readings are taken at the camp or some convenient point at intervals during the day, say one-half or one hour periods, while the field work is being carried on. These two readings of the Aneroid and thermometer allow for a certain amount of corrections under all temperatures and weather conditions. Such corrections, together with ordinary care in handling and reading of the two instruments, will give elevation sufficiently accurate for our purpose in getting the general contour and possibilities for operating, etc. The Aneroid to be read at all heights of

land, abrupt breaks in the contour of land, at the bottom of sags, at streams, ponds, bogs and at periodical distance not over forty rods apart. In this connection there should also be descriptive notes as to the contour of surrounding areas.

Fifth—Consideration of protective measures as to susceptibility of areas to fire, wind and insect damage, with method of handling damaged areas and recommendations for the location of lookout stations, patrol routes, etc.

Sixth—The locating of periodical acre test plots forty rods apart, from which the recording data is taken.

RECORDING DATA.

The recording data deals with the estimate and test plots. The purpose of the test plot is perhaps twofold, by which a check is made upon the estimates by the party along the line of travel, and such detail study of the tree growth condition as may be thought necessary for a workable understanding regarding the condition of trees in the various types.

The work required for getting such data would probably be to count and measure all the merchantable trees on the plot down to a certain diameter limit, say 6" breast high, to be tallied under the different kinds of trees according to their breast height diameter. Explanatory notes as to condition of growth, bottom and slope aspect. To scale a certain number of down trees by the Blodgett caliper rule, giving attention to the stump height, merchantable length and total height. To measure the height of a number of representative standing trees, merchantable height, and total height, with attention to their stump and breast height diameter.

The extent to which such details of work are carried out, will depend materially upon the judgment of the party as to just how far it is necessary to carry this part of the work in order to give a clear understanding of conditions, together with estimates sufficiently reliable for the purpose to which they are to be put.

COMPILING NOTES.

The combining together of collected notes and data into report form, should partly at least, be carried on by the parties in the field in conjunction with the field work.

Such a part of compiling notes would be the carrying on of a rough sketch or map to scale, on which all collected data would be placed as the work advanced, so that all information lacking can be supplied before the parties leave the ground. This work should not materially increase the length of time required for field work, as ordinarily sufficient time would be available on days when weather conditions would not allow the doing of field work to advantage.

TIME AND COST OF FIELD WORK.

The length of time and cost required for the field work depend upon weather conditions and the care and extent to which the detail of the work

is carried. Under ordinary conditions two men will travel from two to five miles a day according to the amount of time given to detail in making explanatory notes and the study of test plots.

The cost of the work carried on by two experienced men will be materially more than if carried on by men who do not thoroughly understand the work and must follow a list of instructions. However, if reliability is to be placed in the report, the extra expense is well made, for a poor report is frequently worse than none at all.

The necessary field work in collecting data for the making of a reliable logging plan, based on the assumed Hypothetical Valley of about 2800 acres would require from 20 to 30 miles of travel taking from 5 to 12 days with a cost of from $75 to $200.

SKETCHES, DESCRIPTIVE REPORT AND ESTIMATES.

On completing the work in the field the putting of the collected data into report form brings us to the consideration of the three divisions of the Logging Plan, namely, the sketches, the descriptive report and the estimates.

The rough sketch in the field may be made with the scale, triangle and protractor in any form that will in a rough way give a check upon the collected data, and is really a part of the field work.

The make-up of the sketches and maps of the logging plan may be divided into three classes of data which are more or less closely related to each other.

First: A division by means of colored lines into types according to the predominating kind of trees, their condition, and requirement as to the handling of merchantable logs found in each type. Such a division to be as broad as the make-up of the tract will allow, for a clear understanding of the tree growth and operating conditions. The main point of division in the logging plan sketch is the operating conditions to which the various methods of logging will have to be applied relative to cost. Such a division as to operating conditions is materially different from a classification based wholly on the predominating kind of trees as ordinarily shown on type or timber maps, and will necessarily be explained more fully in the descriptive report than is possible on the surface of the sketch.

Second: Contour sketches showing the topography and lay of the land by means of lines sketched into scale from the corrected Aneroid readings, a known number of feet in elevation apart, each line representing a certain elevation along its entire length. Such contour lines give a good general outline of the valley and an idea as to kind and logging methods which must be applied.

In this class of woods work it is not possible to get the contour lines less than fifty feet apart, so necessarily between the lines there will be numerous abrupt rises and falls which will not be shown on the sketch or map. With this fact in mind it would seem that one hundred foot contours plainly labeled would be well adapted to the logging sketch as the general outline

would not be affected and the confusion of lines on the surface of the map eliminated.

Third: Showing all streams, their drivable and undrivable length, with a distinction as to long and short logs, dams, falls and necessary improvements, when possible. The locating of all existing or available roads, trails, camps, telephone lines, boxes, fire look-out stations, patrol routes, etc.

The descriptive report has for its purpose the explaining in detail of the general make-up of the plan, as to the purpose, the method used, and a detailed following of the data shown by the sketches and the estimating sheets together with general observations.

Such explanations would logically separate themselves into the above mentioned divisions for consideration.

I—THE PURPOSE OF THE WORK:

The clearly stating of just what ideas the plan proposes to bring out.

II—THE METHOD USED IN THE COLLECTING OF DATA:

1—Crew
- A—Number and make-up.
- B—Time given to the work.
  - (a) Field Work.
  - (b) Office Work.
  - (c) Total Time.

2—Equipment.
- A—Instruments.
- B—Camping Outfit.
- C—Provisions.

3—Method of carrying on field work.
- A—Method of locating topographical features.
  - (a) System of travel.
  - (b) Locating the line of travel.
  - (c) Measurement of distances.
- B—System of estimating.
- C—Method of ascertaining the condition of tree growth and the checking up of estimates
  - (a) Size and number of test plots.
  - (b) Detailed outline.

4—Compiling of notes and the making of reports.
  - (a) By whom, how and when.
  - (b) Time and cost.

DESCRIPTIVE EXPLANATION OF SKETCHES AND GENERAL OBSERVATIONS.

1. A consideration and explanation of the reasons for dividing the area into distinct classes or types, with a clear description of the tree

growth and topography to make clear the reasons and basis for such a division.

2. Streams, their adaptability to driving and storage purposes as to size, stream bed, banks, tributary conditions and the method of procedure necessary to put the stream into working order.

3. A full explanation as to the method used in the locating of contour lines and observations.

4. A thorough description for existing, possible or available improvements on tracts as to logging roads, tote roads, camps, dams, stream improvements, telephone lines, etc.

5. The present or future requirements for protective measures in relation to fire, insect or wind damage.

6. The method and system of estimating, with an idea of making plain just how much reliability may be placed on the amounts, distances and costs.

7. The kind, amount and extent of attention given to the condition of the tree growth.

8. Such general observations and recommendations which in the judgment of the party may be of use in the management of the valley.

9. The consideration of the general location of the valley and its relation to the surrounding region.

ESTIMATING SHEETS.

The purpose of the estimating sheets is to give a clear, concise outline of existing conditions with figures as to the amounts and cost of the different classes of timber which may be expected from the area under consideration. These should be in such form that a lumberman totally unfamiliar with the region would be able to understand what results could be expected from the applying of certain methods of operation, by giving due consideration to the system by which the figures were made and the judgment of the estimators.

The number of divisions in a logging estimating sheet could be carried to a considerable length. If all points relating to the condition of growth, amounts and operating costs were given, such a sheet would probably be long, cumbersome and not easily understood. This fact seems to point to the consideration of only such points as would bring to the experienced mind certain definite conditions with accompanying figures without going into unnecessary details.

OFFICE WORK

The amount and extent of office work required for putting into report form collected data depends materially upon the method and care with which the work is done in the field.

A systematic method of collecting data, with clear, well explained notes, makes the plotting of sketches an easy matter of drafting room work. The descriptive reports and estimates will follow the sketches simply and

naturally, requiring from two to four days of actual office work for the ordinary sized valley.

The extent to which the logging plan has been considered in this paper is in fact only a brief outline of the condition and possibilities to which the plan may be carried and is simply a bases for actual management as to what, when and how the different classes of merchantable timber can be cut, with all necessary details for carrying on the work.

Such a plan might be compared in a rough way to a reconnoitering railroad survey, which has to do entirely with the possibilities of available routes, upon which is based the actual building of the road.

There remains, however, much to be done in working out a method and system of procedure before the Logging Plan stands on the same basis of reliability as preliminary engineering plans.

This reliability in the Logging Plan is undoubtedly attainable and only remains to be worked out with applied Forestry principles together with practical and economical logging methods.

Range and Characteristics of Merchantable Trees

In Maine, New Hampshire, Vermont and the Province of Quebec.

By J. F. Heck.

GENERAL CONSIDERATIONS.

CLIMATIC factors, temperature and moisture conditions, determine in the first place the field of natural distribution of the various species. The average temperature of a region is of less importance in determining the range of trees than the lowest and highest extremes of temperature. The average temperature of a certain locality where it never freezes may only be 60 degrees, while another locality with an average temperature of 70 degrees may have occasional frosts. Trees which could not live in the latter temperature on account of the frosts would thrive in the lower average warmth of the former free from frost.

In these extremes we have the explanation of the inability of the Live Oak of the south to grow in Maine and the Paper Birch of Maine to grow in Georgia.

In many cases the requirements of water control the range of trees altogether. The strikingly zonal structure or arrangement of habitats is nearly always due to the difference in water content produced by physiographic factors such as slope, exposure, surface and altitude.

Aside from these factors the general distribution of forests is influenced by the physical character of the soil. Under a certain combination of soil conditions each species makes it best development, called its optimum.

Again, the position or numerical distribution of trees may be primarily influenced by the relation existing between seed production and seed dissemination. The individuals of species of great seed production with little or no mobility usually occur in dense stands. In these the competition for space is fierce for the two reasons of similarity and density. When the seed production is small the mobility may be great or little without seriously affecting the result. The individuals of species of this kind will be scattered among those of other species and the closeness of competition will depend

largely on the similarity existing between the two. The arrangement in such cases is sparse. These two types of arrangement form the basis for the investigation of abundance which deals essentially with the number and arrangement of the competing species.

It may be stated as a general principle that vegetation moves constantly and gradually toward stabilization. The activities of man in changing the surface of the earth are so diverse that it is difficult to fit the resulting succession of forests in a natural system. While man does not exactly make new soils he exposes soils in his various operations such as mining, lumbering and cultivation, circumstances not in the regular course of nature but which may entirely change the conditions and cause the appearance of a new forest type. Types following any change of this sort are temporary forest types and if left to themselves will change into the permanent type or the form and composition the forest had before the artificial change took place.

THE WHITE PINE—*Pinus Strobus.*

The natural range of the white pine extends from eastern Maine southward along the Atlantic coast to the mouth of the Chesapeake bay, along the eastern slope of the Appalachian mountains to northern Georgia ; along the western slope of the mountains of Virginia and in a northwestern course across southern Ohio, central Indiana and Iowa the the western line of Minnesota.

The white pine region of the northeast extends thru southern Vermont, New Hampshire and Maine, bordering the sea coast. The region is largely below the 500 foot contour line while the northern hardwoods and spruce regions occupy the more elevated territory behind. Rolling hills of sand deposited by glacial action cover nearly the entire country. In these situations the tree attains an age of 300 years and reaches a height of 100 feet and a diameter of 5 feet.

In the Province of Quebec the white pine does not pass the 49th degree of latitude. There are some good stands in the county of Charlevoix between the rivers of Saguenay and Malbaie. The best developement in white pine is found in the St. Maurice and Ottawa regions principally in the valleys of Noire and Coulonge rivers and along the valleys of the Rouge, Lievre and the Petite Nation rivers.

Tne tree is very indifferent in its demands upon soil and moisture and thrives upon all but the very driest soils. It makes its best development, however, in fairly moist loam.

The white pine stands at the head of the list for general usefulness as a timber tree. Its wood is light, not strong, straight grained and easily worked. It is largely manufactured into lumber, shingles and laths, and used in construction for cabinet making, the interior finish of building, woodenware and matches.

RED PINE—*Pinus Resinosa.*

The red pine or Norway pine has about the same natural range east

and west as the white pine but does not extend as far south. It is a very valuable but comparatively rare tree in the New England states. It mingles with the white pine as its demands for soil, moisture and light are about the same.

The natural habitat of the red pine is essentially a northern one. In the Province of Quebec the red pine ranks second to the white pine in quality and in quantity and its range is approximately the same.

The wood of red pine is hard and very close-grained; it is largely used in the construction of bridges and building, for piles masts and spars.

RED SPRUCE—*Picea Rubens.*

The red spruce is distinctly an eastern species ranging west from New Brunswick and Nova Scotia thru New York, Maine, New Hampshire and Vermont and down along the Appalachians as far as Georgia.

Thruout its range it is adapted to the elevated regions, altho it does not establish itself on the very crest of the mountains. It is the predominating tree of the region of the White Mountains of New Hampshire and extending north and south thru the center of the state of Vermont on the Green Mountain range.

In Maine it occurs on the broad plateau extending northeast on the western side across the Rangeley and Moosehead lake districts, gradually sloping eastward toward the Penobscot river basin and toward the sea level.

From Maine the range of the red spruce extends into the Province of Quebec forming its best development in the Chaudiere river valley and in the region of Lac St. Jean where, together with the white and black spruce it may form 75 per cent of the forest.

The wood of red spruce is light, soft, close-grained, not strong. It is manufactured into lumber and used for the flooring and construction of houses, for the sounding boards of musical instruments and for the manufacture of paper pulp.

WHITE SPRUCE—*Picea Alba.*

The white spruce is essentially a cold climate tree. It is commonly called the Canadian spruce because it forms the great bulk of the forests in northern Canada, reaching far into the frigid zone where it grows on tundras that are never free from frost.

The white spruce ranges along the northern border of the United States from Idaho to Maine and northern New Hampshire and Vermont. It attains its best development along the northern portions of Vermont and Maine occuring, however, only in scattered locations.

The tree is found in all parts of the Province of Quebec, and in nearly all locations it attains sufficient dimensions for saw logs and pulp wood. Along the borders of the Bay of Rigolet and in the valley of the Hamilton river until 250 miles from the sea, the white spruce forms pure forests where the areas have not been burnt over. In the immense country traversed by

the Nottaway river occupying a territory of 20,000,000 acres, the white spruce forms the dominating species, often reaching a height of 100 feet and a diameter of 3 feet. Exceptionally large trees are found in the valley of the Chaudiere river in the county of Metgermette.

The white spruce adapts itself to all soils and situations. Nothing seems to offer an obstacle to its vegetation. Naturally the quality of the wood and the size of the tree are influenced by its situation. It obtains its best growth in the valleys and along the borders of streams.

The wood of white spruce is light, soft, not strong, straight-grained. It is manufactured into lumber, used in construction, for the interior finish of buildings and for paper pulp.

BLACK SPRUCE—*Picea Nigra.*

The black spruce is principally a swamp species. It occurs thruout the states of Maine, New Hampshire and Vermont and is confined to a soil that is apt to be wet thruout the year, covered with a dense bed of sphagnum moss. In these regions it is a small tree and of little commercial value.

In the Province of Quebec the black spruce is the dominant and characteristic tree of the territories of Abitibi, Mistassini, Ashuanipi, the counties of Chicoutimi, Saguenay and the northwestern extremities of the counties of Champlain, St. Maurice, Maskinonge, Berthier, Joliette and Montcalm. In these regions the black spruce forms about three-fifths of the conifers suitable for commercial purposes.

The black spruce often forms pure and very dense stands. As many as 500 to 700 trees may be crowded on one acre. While the tree mingles freely with the white spruce it is more or less adapted to cold swamps and less favorable situations.

The wood of black spruce is light, soft, not strong, pale yellow white with thin sapwood. Its principal use is for the manufacture of paper pulp.

BALSAM—*Abies Balsamia.*

The tree is a northern species extending from Labrador down thru the northern states and is confined to the states bordering on the Great Lakes, Virginia, Maryland, Pennsylvania, New York and the New England states.

In these regions the balsam occurs everywhere, associating with the spruce and hardwoods and occasionally forming pure stands. In the spruce flats the balsam reproduces exceedingly well sometimes covering 20 to 30 per cent of the area.

The tree is more cosmopolitan as regards soil and moisture than the spruce, but in general prefers more moisture. The balsam is an exceptionally prolific reproducer. Wherever in a mixed stand of spruce and balsam a cutting is made the reproduction is sure to largely balsam.

The balsam is generously distributed thruout the entire Province of Quebec. Its range extends far north, reaching the Ungava Bay region.

NORTHERN WHITE CEDAR—*Thuya Occidentalis.*

The tree is a northern species common thruout eastern Canada, extending along the boundary of the United States from Maine to the Red River of the north and south to central Minnesota and Michigan, northern Illinois and in the Atlantic regions along the mountains to North Carolina.

In the states of Vermont, New Hampshire and Maine, the northern white cedar occupies the swampy ground bordering the banks of streams and shores and lakes. In these situations the tree forms a dense and valuable but very slow growth. The best individual specimens of cedar are found in the spruce flat types, where the timber is of much better quality than in the swamp forests. In the latter situations the wood is frequently very unsound.

The white cedar is found in all parts of the province of Quebec south of the St. Lawrence river. It is the predominating tree of the Temiscouata region. To the north of the river its range is limited by a line from the mouth of the river Penticote extending southward and passing to the north of Lac St. Jean, to the source of the river Gatineau, running northwest along the mouth of the Rupert river on the border of James Bay. Its best development occurs in the valley drained by the Bonaventure river where the tree reaches a diameter of 6 feet and a height from 50 to 80 feet.

The wood of the northern white cedar is light, soft, brittle, very coarse-grained and durable; it is largely used for fence posts, rails, railway ties and shingles. Fluid extracts and tinctures made from the young branchlets are sometimes used in medicine.

TAMARACK—*Larix Americana.*

The tamarack is one of our most northern trees, ranging from Labrador to Alaska and south to Illinois and Pennsylvania. In the northeastern states it is not a common tree but is found in restricted localities, usually on the border of a swamp.

In the Province of Quebec the largest trees of the species are found near James Bay, growing in elevated and dry regions. The tree is abundant around Lac St. Jean and Lake Mistassini where it often forms pure forests. It is one of the most valuable forest trees of the Province. The tree is very rare in the silurian deposits of Gaspesie and is almost unknown in the larger part of the county of Bonaventure.

The wood of the tamarack is hard, heavy, very strong, rather coarse-grained, very durable; it is largely used for the upper knees of small vessels, fence posts, telegraph poles and railway ties.

HEMLOCK—*Tsuga Canadensis.*

The range of hemlock extends from Newfoundland west to Minnesota and south to Georgia. It is rather a tree of the hill-side than of the plain and prefers cool glens and ravines.

Thruout the states of New Hampshire, Maine and Vermont it generally occurs in groups. The soils on which the tree finds its optimum growth are medium to fairly good in quality. Hemlock mingles freely with white pine, chestnut, red oak, maple, white ash, and basswood.

In the Province of Quebec hemlock is rarely found in pure stands. Toward the east its range does not pass Cap Tourmente and its northern limit generally does not pass 47 degrees of latitude. The tree is found in abundance on inferior territory of the St. Maurice and Ottawa rivers and around Arthabaska.

SUGAR MAPLE—*Acer Saccharum.*

The range of the sugar maple extends thruout the eastern part of the United States, from the Atlantic to the great plains of the Dakotas and Oklahoma and south to the Gulf of Mexico.

It occurs everywhere thruout the states of Vermont, New Hampshire and Maine. The tree is most abundant in the eastern parts of Vermont and the western parts of New Hampshire. In these regions the tree finds its optimum growth in the United States, often forming pure stands and even where it mingles with the conifers it may form 50 to 60 per cent of the forest. It seldom occurs on sandy soils and is preferably a lime loving species.

In the Province of Quebec the northern limit of sugar maple rarely exceeds 49 degrees of latitude and does not go north of Lake Temiscamingue. As in the States the tree is very cosmopolitan, growing in all localities with the exception of very moist situations.

The wood of sugar maple is heavy, hard, strong, close-grained and tough; it is largely used for the interior finish of buildings, especially for flooring, in the manufacture of furniture and turnery, ship building and fuel.

YELLOW BIRCH—*Betula Lutea.*

The range of the yellow birch extends westward from Newfoundland and Nova Scotia into Minnesota and south in the Appalachian mountains. The tree occupies soils that are usually of good depth and fairly rich. Yellow birch occurs thruout the states of Maine, New Hampshire and Vermont where it mingles very freely with the spruce and fir occuring on the flats. In the central and level portions of Maine and in Aroostook county where there are many lakes and sluggish streams, the yellow birch often forms 50 per cent of the forests.

In the Province of Quebec the range of the yellow birch generally does not exceed 49 degrees of latitude. Up to this limit it attains large dimensions. Generally speaking, in the regions of the St. Maurice and Ottawa rivers the yellow birch reaches its best development.

The wood of yellow birch is heavy, very strong, hard, close-grained. It is largely used in the manufacture of furniture and hubs of wheels.

WHITE BIRCH—*Betula Populifolia.*

The natural range of the white birch extends across the continent to the rocky mountains but not very far south. In the northeastern states the white birch adapts itself to all soils and situations. While it is indifferent to these requirements the tree is very exacting as to light conditions and can only thrive where there is an absence of shade. For this reason the white birch forms only a temporary forest type and while its range is confined to a certain prescribed area, the numerical distribution of the tree is a variable quantity.

In the Province of Quebec the white birch is also very cosmopolitan as to its requirements for growth. In sterile and hot soils, however, the tree remains small, while in a more favorable situation the tree may reach a height of 60 or 70 feet and a diameter of 16 to 18 inches. In the regions of Lake Edward, Matane river and in the neighborhood of Chicoutimi, white birch grows in pure forests from which saw logs are obtained.

The wood of white birch is soft, not strong, close-grained and not durable; it is used in the manufacture of spools, shoe pegs, paper pulp and also for fuel wood.

WHITE ASH—*Fraxinus Americana.*

The white ash occurs thruout the eastern half of the United States, extending west into Nebraska and Texas and south into Georgia and Mississippi. Its best development is claimed to be in the Ohio river basin. In the northeastern states the tree is found in all sections, but is most common in the hardwood belt lying between the boundary of the states of Vermont, New Hampshire and in the central portions of the state of Maine. The white ash usually occurs as individuals mixed with other trees, seldom forming a large proportion of the stands. In the first 70 years of its life the white ash is a very rapid grower and next to the white oak is the most valuable of all genuine hardwoods.

In the Province of Quebec the white ash is confined almost solely to the territory south of the St. Lawrence river. North of the river it occurs around Keepawa lake and in the better soils of the valley of the Ottawa river.

WHITE OAK—*Quercus Alba.*

The white oak is essentially a southern tree extending up into the New England states from the southern regions. The white oak finds its best development in the southern portions of Vermont, New Hampshire and Maine. It is not especially fastidious as regards to soil but does not thrive in swamps. Commercially the white oak is the most valuable species of our northeastern forest.

There are some excellent stands of white oak in the Richelieu and Yamaska valley in the Province of Quebec, where reserves were formerly established to furnish timbers for the royal navy. The range of the white

oak does not pass 47 degrees of latitude and its northern limit is bounded by a line drawn between Cap Tourmente and the mouth of the Mattawa river.

The wood of white oak is strong, very heavy, hard, tough, close-grained and durable. It is used in ship building, construction work and in cooperage, the manufacture of carriages, interior finish of houses, cabinet making and railway ties.

Forest Fire Protection.

By F. H. Billard.

ABOUT fifteen years ago there began an advance in the price of standing timber throughout the country which has continued up to the present time. This increase in value brought a general demand for adequate fire protection which was further stimulated by the losses of the dry seasons of 1903 and 1908.

The single handed efforts of individual land owners to protect their standing timber was found expensive to the owner and ineffective in securing satisfactory results, consequently were soon superseded by the organized action of the Federal and State governments and co-operative association of timberland owners. In different states the pioneer, in the movement toward better fire protection, has been one or the other of these three agencies and the best results have been secured in those localities where all three are working in close co-operation. The degree of responsibility belonging to each of these agencies, the special benefits gained by their participation in the work and the limitations and obstacles each is handicapped by may be briefly summarized as follows:

The first problem faced by the Forest Service when it was made responsible for the administration of the vast areas of public land set aside by Congress as forest reserves was the necessity of keeping fires out of the immense tracts. Today, although the protective machinery is still in the constructive stage, it is keeping the average annual loss to a minimum on an area of nearly two hundred million acres at a cost per acre which is insignificant.

The success of the Forest Service in this undertaking has been of immense value as a demonstration of the possibility of obtaining reasonable security of timberland investments without prohibitive cost. It has served as an example of the most practical methods and has been followed by many States and protective organizations.

Up to 1911, the only aid furnished to States by the Federal Service was by advice and instruction in organizing fire protective departments. In the spring of 1911, Congress passed what is known as the "Weeks Law." It provided $200,000. to be used in the protection of forests on the watersheds of navigable streams in co-operation with the States, where these are located.

This has enabled the States, sharing in this appropriation, to establish and maintain a thorough system of fire protection at a much earlier time than their own resources would have permitted. It is expected that the protective and preventive features, so introduced, will be continued on the same scale by the States so benefited after the withdrawal of the Federal assistance.

REASONS FOR STATE AID.

The reasons why a State is justified in going to considerable expense to protect its forests do not seem to be fully appreciated. First, a direct loss is suffered by the State itself in every forest fire by reason of the taxable interest it has in the timber destroyed. This loss is more absolute in forest property than in other forms of real property as it cannot be covered by insurance, hence it is removed from the tax list during the period of years required by nature to replenish and re-seed the soil and bring the crop to an age of taxable value.

The history of the timber wealth of Michigan and Wisconsin furnishes an excellent example of how a State may suffer in this way. The forests of these States were exceptionally valuable because of their high grade pine timber and its accessibility to first-class markets. Protection was unheard of at that time and the cut over areas were repeatedly burned, rendering the chance of a future crop so slight that the owners declined to pay taxes even on the land and let their titles lapse. In this way these States lost the income derived from the taxation of thousands of acres of land and became the owners of barren tracts which ever since have been a burden and source of expense.

The total amount spent in wages to complete the logging, manufacturing and marketing of one thousand feet of timber is greater than the value of the mature standing timber necessary to produce that amount of lumber.

The amount of money spent in a forest region by visiting nature lovers, health seekers and sportsmen is difficult to estimate, but is conceded to be a source of considerable revenue.

The total sum derived directly or indirectly from the forest is distributed through and benefits all classes of business, accordingly is an asset, not of the individual, but of the community and as such clearly places the responsibility on the State of bearing its share of the expense of caring for and protecting this public resource.

The existence of a State department for forest protection encourages enterprising towns to take advantage of State aid and inaugurate protective and preventive measures at an earlier date than would be possible if dependent on their own resources alone; on the other hand, in towns where public opinion is backward on the subject, it stimulates interest, makes compulsory a certain amount of prevention work and forces prompt action in the fighting of fires which do occur. In the case of fires involving more than one town, it provides the common meeting ground on which to establish

close co-operation and furnishes a clearing house to settle all questions of authority, responsibility and the division of expense.

It is a difficult matter to draw up a law containing a general plan for the forest protection of a State where the types of forest and topography differ widely in different sections of it. New Hampshire is a good example of this difficulty. The extensive mountainous spruce forests of the north and the pine wood lots of the south requires different treatment and methods. The subsequent enactment of such a law is still more difficult as the control of most Legislatures is in possession of the representatives from the city districts who are, as a rule, neither well informed nor well disposed toward such legislation, consequently the bill as finally passed is the result of a series of compromises with trimmed appropriations and shorn authority.

Other obstables to the effective operation of a State department for fire protection are: First, the impossibility in time of emergency of taking any action or incurring any expense except such as was anticipated and authority secured by law from some preceding legislature. In an unusually dry year the appropriation is the same as in a wet year and in most States there is no possible way of securing additional funds; second, the invasion of such a department by political office seekers who have neither experience nor enthusiasm for the work and are subject to change with every defeat of the party in power.

Just what percentage of the responsiblity and expense of protecting his timber belongs to the owner and what part should be assumed by the State is a question which has received a variety of answers in different parts of the country. Twenty States now have an organized forest fire department and collectively appropriate a little over $500,000. annually. Thirty-one protective associations of timberland owners are now in operation in ten States, and although the average total amount spent by these associations will not equal the amount spent by the States, yet, in dry years, the expenditures of the association are undoubtedly greater than those of the States, which would indicate that the landowners are doing the larger share of protection work in times of emergency when it is most needed.

The first co-operative protective association of land owners was formed in Idaho in 1906, and since then twenty-four others have been organized in the west, in the States of Idaho, Colorado, Montana, Oregon and Washington. The first one in the east was formed in New Hampshire in 1910, and was followed by others in Michigan, Maine, Pennsylvania and West Virginia.

The cost of protection is figured on an acreage basis and each member is assessed according to his holdings.

The policies of the associations are not uniform; nearly all undertake organized patrol and some do their own fire fighting as well.

The private associations have the advantage of being able to secure promptly such funds as are needed to meet any situation and have freedom of action which enables them promptly to take advantage of any new and

promising method of protection. An instance of this is the construction of look-out stations in New Hampshire by the association and their subsequent sale to the State after their value had been demonstrated.

A thorough knowledge and close study of the causes of forest fires is fundamental to successful protection. A general list of the most prominent causes of fires throughout the country can readily be given, but it is of little value when applied to a given locality.

The protection of any tract is an individual, ever-changing problem in which the risk may diminish or increase from year to year and the most common causes of fires will vary with different parts of each season. The changes in the causes of fires and in their relative importance in an average New Hampshire town during a season may be enlightening. The chief causes of fires early in the spring are fishermen, river drivers, brush burning to clear land; these diminish or disappear as summer begins and are replaced by summer logging crews, summer visitors, picnic parties, campers, automobilists, thunder storms and berry pickers. When fall comes the blame for the majority of fires must be borne by the hunters and campers.

Throughout the season the railroad locomotive is a source of frequent fires and in many States has been the subject of much legislation without anywhere obtaining entirely satisfactory results. The usual laws provide for some or all of the following precautions or penalties: The use of oil as fuel, the equipment of the engines with spark arresters, the clearing of the right-of-way, compulsory patrol during dry times and complete liability for the damage caused by fires so set in addition to defraying the expense of fire fighting.

All protective measures may be classified under the heads of prevention or control. The preventive measures are a result of the study of the causes of fires and aim to remove them, as far as possible; when prevention fails and fires do start the measures of control are meant to provide means to promptly put them out.

Next to a friendly alliance with the weather man, organized patrol is the greatest factor in fire protection as it is both a measure of prevention and control. A wide awake patrolman may be depended on to put out, unassisted during a season, quite a number of small fires, but it is the fires which do not occur which make his work important. His work discourages carelessness with fire and creates a growing public sentiment in favor of better forest protection, which eventually will make an intelligent individual exercise in the forest the same care in the use of fire which he would exert in his own home.

To control the fires which do occur it is necessary that they shall be discovered and reported promptly and that there shall be no delay in collecing and dispatching a suitably equipped crew to the scene. Prompt information as to the existence and location of fires is supplied by mountain lookout stations and woods telephone lines built to the most remote regions; that there may be no delay in securing a crew is avoided by making arrangements in advance wherever possible; trails are built in order that

there may be no uncertainty or delay in arriving at the fire; many States and associations now provide tools and camp outfits as a further time saver.

The obstacle to the smooth carrying-out of this well planned system is the fact that the organization is temporary and the beginning of each season finds a large percentage of new men employed whose severest test comes as soon as they begin work in the spring before they can become familiar with their duties either by instruction or experience.

RAPID BLANC, THREE QUARTER MILES ABOVE CREEK LA BOUTEILLE, APPROXIMATELY 4000 LOGS.

ROCKS TO BE BLASTED HALF MILE FROM HEAD OF RAPID BLANC.

APPROXIMATELY
4000 LOGS.

SPRING FLOOD LAND
WEST OF ST.
MAURICE RIVER,
BETWEEN GRAND
PIERRICHE, AND
PETIT PIERRICHE,
200 YARDS FROM
RIVER.
APPROXIMATELY
1000 LOGS LEFT.

Photography as Applied to Forestry Engineering.

By John H. Graff.

COMMERCIAL PHOTOGRAPHY.

THE old idea that our forefathers' way of doing things is good enough for us has passed long ago, and today, if we wish to succeed, we must do things better than they have been done before. Accordingly every kind of business has developed along scientific lines and no business has made more rapid progress within the past few years than Forestry. It is not only in itself a science but it also takes all other sciences and arts into its service. One of the arts which it has used to great advantage is photography, the particular branch of which is correctly termed commercial photography.

Photography has been generally thought of as a process for producing likenesses of persons or views pleasing to the eye but of little practical value. Within the past few years, however, the commercial branch of photography has been developed very rapidly so that today it can be put to numerous valuable uses for commercial and scientific purposes.

The different uses of photography in forestry might be divided into three groups, as follows: (a) Office and Studio Work, (b) Field Work, (c) Scientific Work.

OFFICE AND STUDIO WORK.

Much of the studio work is closely associated with the field work, but probably the most important part of it is that connected with mapping. The old way of reproducing maps by the ordinary blue print process has never proved satisfactory because when it is desired to obtain a copy from same a new drawing has to be made at considerable expense. With the equipment which the Berlin Mills Company now has prints in black and white can be produced from tracings, also maps and drawings from any print, and they may also be reduced or enlarged as desired. This work may be divided into the following groups: (1) Contact Prints, (2) Reproduction and Reducing, (3) Process Work and Enlarging.

CONTACT PRINTS.

These are made from tracings on an ordinary blue-printing machine and a print can be produced at any time of day or night, using any of the following grades of prints:

(a) Blue print (paper and linen), (b) Umbra prints (black lines on white, thick or thin paper), (c) Maduro negatives (white lines on brown paper), (d) Maduro positives (dark brown lines on white paper).

The Maduro positive prints can be made on thick or thin paper and also direct onto linen.

It should be constantly kept in mind that no tracing should ever be colored as the place which is colored on the tracing will give white or black blotches on the print.

The Umbra and Maduro papers can be colored as easily as an ordinary drawing, but they should always be mounted on linen for the reason that all sensitized papers are more or less brittle. The cost of the different prints is as follows:

Paper blue prints	3c	per	square	foot.
Linen blue prints	8c	"	"	"
Umbra black process prints	9c	"	"	"
Maduro paper prints	8c	"	"	"
Maduro linen prints	10c	"	"	"
Linen mounting for any paper	8c	"	"	"

REDUCTION WORK AND REDUCING.

This work is done on a machine called the Photostat, patented and introduced for commercial work in 1911 and since then used extensively by the United States Government and many of the largest corporations in this country. With this machine anything printed, drawn or written, color, ink or pencil work, may be photographed onto paper without the use of a plate. The reproductions are 13"x18" and the first photograph gives white lines on black paper, but again photographing these, black lines on white paper are obtained. Photographs of blue prints gives black lines on white paper. As the capacity of the Photostat is only 13"x18" it is clear that anything larger must be reduced; but if the original size is required the photograph can be made in sections and afterwards pasted together or mounted on linen. Smaller objects can be photographed on half sheets 9"x13". The work on this machine is exceedingly fast averaging about two minutes for each print, and the cost, counting all overhead expense, salary, etc., is ten cents for a half sheet and twenty cents for a whole sheet.

PROCESS WORK AND ENLARGING.

If it is desired to enlarge or reproduce a drawing without having to redraw or trace the same process work is used. This has its name after the plates used for the work—The Process plate. These plates are exceedingly contrasting and especially manufactured for photographing of line work.

The map or drawing to be enlarged or reproduced is first photographed on an 8"x10" plate which is of standard size, and afterward enlarged to any size desired to exact scale and with clean black lines on white paper.

The cost of this work is variable so that the price must be determined for each separate case. The saving by this method is, however, very great. For example: A map which was recently reproduced at a cost of $18.00 would, by the old method, have taken an expert draftsman from three to four months to re-draw and trace.

These methods of reducing, enlarging and copying maps are not only time and labor saving but they give much more opportunity for building up a practical and uniform map system.

PHOTOGRAPHY IN THE FIELD.

In addition to the work of the professional photographer as described above, much valuable information may be gathered with the aid of photographs taken by the men connected with the outside work. Photographs will give exact reproductions of scenes as they appear, whereas written reports by different men will vary in many particulars in describing the same situation. Photographs are, therefore, a great aid if used in connection with written reports, to substantiate statements made therein.

Every logging superintendent, surveyor, estimator and scaler should be provided with a standard camera so that he may take photographs of anything of interest connected with the work, as for example: Timber stands, types of trees, dams, bridges, sluices, water-falls, road conditions, camps, accidents which may occur, etc.

To perform this work intelligently, however, consideration should be given to the following points: (1) The camera best adapted to the work, (2) proper exposure, (3) the principles of development, (4) reports, (5) lantern slides, (6) special work.

THE CAMERA.

Every large timber concern should equip the men who are in charge in the woods with standard cameras, but as this is not done at the present time, it being the custom for each man to furnish his own camera, it will be well to consider the kind which is best adapted to this work, for the guidance of those who may wish to provide themselves with the best kind. The government uses principally two kinds, one similar to No. 3 A. Kodak for films, and the other of about the same size, used exclusively for plates.

There are a few requirements for a camera to be used for this class of work. It should be as simple as possible, having anastigmat lens and equipped so that both films and plates can be used with an exposure surface of 3¼"x4½". The reason for having it adapted to both films and plates is that, while for ordinary purposes exposures on the film will be sufficient, this will not be the case in timber stands, etc., for the reason that to obtain details it is necessary to give long exposure in order to show details which are back in the shadows, and plates are best adapted for the purpose.

The camera should be $3\frac{1}{4}$"x$4\frac{1}{4}$", for the reason that this is a convenient and light size to handle, and is a practical size for direct single prints and also enlargements. Also because it is the standard size of the commercial lantern slide, and, as lantern slides are being more and more used in connection with the educational work conducted by large concerns, it is advisable to use this size.

EXPOSURE.

Exposure and development have a direct bearing one on the other, and exposures that are either under time or over time must be developed to meet the special requirements incident to such exposure. When making an exposure to get some special details it is necessary to expose several times longer than the ordinary time used from the pictorial points of view, but it is very essential that the exposure should be marked to show the kind of picture, time of the day and year, condition of light, opening of lens and exposure given. These details, should, in fact, be furnished with every exposure that is sent in to the Photographic Department for development.

PRINCIPLES OF DEVELOPING.

In order to better understand the necessity for sending in exposure record for every picture taken the underlying principles of developing these exposures should be understood.

The film or plate used is first coated with a gelatine on which is a second coating of silver, or what is generally called the sensitizing. When the film or plate is exposed to the light the sensitized coat will be affected accordingly as the light strikes the plate and, as bright light makes a quicker impression on the plate than the shadows, it is necessary to time all exposures where detail is wanted for the shadows or, in other words, to give the faint lights in or on the object time and opportunity to act on the coating of the plate.

The developing consists of removing from the plate the silver not affected by the light and to oxadize the silver that is going to make the negative into a plate. To do this we use a developing agent, usually pyro, sulphite of soda, to prevent the developing agent from discoloring the plates; and carbonate of soda to open the pores in the plate and giving developing agent an opportunity to act on the silver.

As before stated the high lights act quicker on the plate than the shadows, and the developing agent will accordingly develop these first, therefore to be able to develop the deep shadows we have to cut down considerably on the amount of the carbonate of soda used, or, in other words, not open the pores of the gelatine faster than the developing agent gets time to act on the shadows before the high lights are over developed.

SCIENTIFIC WORK.

Photo topography has long been considered as something useful for a scientific and practical surveyor, but it has taken a long time to make it not

only theoretical but also a practical success. The idea originated in England. Work of this kind has been done in the United States, but it has remained for the Austrians to apply it in practical work. The method is as follows:

All good points of observation, such as mountain peaks, church spires, hill tops, signal towers, etc., are put in on the map by the ordinary triangla-tion method and from these points panoramic or birdseye views are photographed. From the pictures obtained in this way the map is drawn in between the trianglation points under certain rules as to the planemetric scale and the perspective scale's relation to each other.

These methods could readily be applied in forestry and the most practical instrument for the same would be a special panoramic camera on a transit with the telescope taken out.

The application of photography to the practical work of a forester is very new; but the more we look into it, the more we find it practical and useful and I am convinced that with individual application combined with common sense and good-will photography will prove one of our best assistants for good results in the work of forestry.

The Use of Log Driving Dams.

BY JOHN J. DELANEY.

PURPOSE OF THE LOG DRIVING DAM.

THE log driving dam has for its ultimate purpose the sure and economical transportation of logs and pulpwood by securing a sufficient flow of water as needed for driving. This is insured by means of:

1st—Keeping a constant regular flow, and the making and maintaining of a pond for the storage of water and logs, by the use of a storage dam.

2nd—A quick method of increasing or decreasing the flow as required, by the use of a squirt dam.

3rd—The submerging of rough parts of the stream bed, by the use of a roll dam.

4th—The temporary control of a certain amount of water for a short time, by the use of a horse dam.

STORAGE AND SQUIRT DAMS.

The underlying principles of the storage and squirt dams are very similar in that their construction is much alike. There is, however, a vast difference in operation of these two kinds of dams.

The storage dam attains its object by having a so-called long head, or a large volume of water behind it, with which it is enabled to keep a constant flow for a comparatively long time, and at the same time to maintain a pond for the storage and handling of the wood and logs. The squirt dam is characterized by the so-called short head, which gives frequent spurts of water lasting only a short time.

LOCATION OF STORAGE AND SQUIRT DAMS.

The storage dam may be built on drivable streams where there are solid banks, rock or gravel preferred, on both sides of the stream, and a flat, level area above the dam for storage room or pond.

The squirt dam is built on streams where there is little available storage room, and should be located where as much head as possible can be obtained to materially increase the flow after the dam has been filled, even

though the flow lasts only a comparatively short length of time. Several such locations for squirt dams might be found on a long drivable stream which has a number of falls or rough places in the stream bed, over which the logs would not run smoothly with the ordinary flow of water. Squirt dams at the head of these places would quickly collect sufficient water to overflow them for a short length of time.

If, however, banks can be found with a sufficient flat area or flowage for the holding of a comparatively large amount of water above the succession of falls, a storage dam would eliminate the necessity of the so-called short head at a cost not materially greater than that for the squirt dam, and would have the added advantage of a storage space for logs, so that a certain amount of driving could be carried on above the dam, while the gates were closed for the holding of water. Or if at any time in driving below the dam more or less water was wanted than the ordinary driving head, it could be obtained by hoisting or shutting down one or more gates. These advantages are not possible with the squirt type of dam.

COMBINED STORAGE AND SQUIRT DAMS.

Storage and squirt dams may be used advantageously together where an available storage can only be had at some distance from the drivable head of the stream. Such a condition is common at the head of a large river where the upper tributary or tributaries are small and rough. This necessitates the construction of a storage dam some distance below the extreme upper point from which logs might be driven and leaves a part of the drivable length without any control of the water for driving. A squirt dam located as far up the tributary stream as it is possible to drive logs, can be used to great advantage in driving the logs into the flowage of the storage dam, on the main stream and control driving conditions as follows:

By holding a comparatively large body of logs, which can be sluiced through and handled to better advantage than by the squirt dam. By the working of the logs above and below the storage dam at the same time. That is, landings below may be broken out and driven, while the logs above are being worked by the squirt dam down into the pond, to be there held until a hole is made through the landings and the river is clear for the running of the logs. By maintaining a constant flow which will carry the logs a long distance, well illustrated by a pail and barrel of water turned into a small dirt drain separately, in such a manner that the drain is kept full. The pail of water must be turned in quickly and will last only a short time, whereas the barrel turned in gradually will maintain a long, constant flow which will go several times as far. By its ability to conserve or hold a certain amount of water until the last of the drive, when the natural running is small, and a constant flow is necessary in order to finish up the drive and take off rear along the banks of the stream.

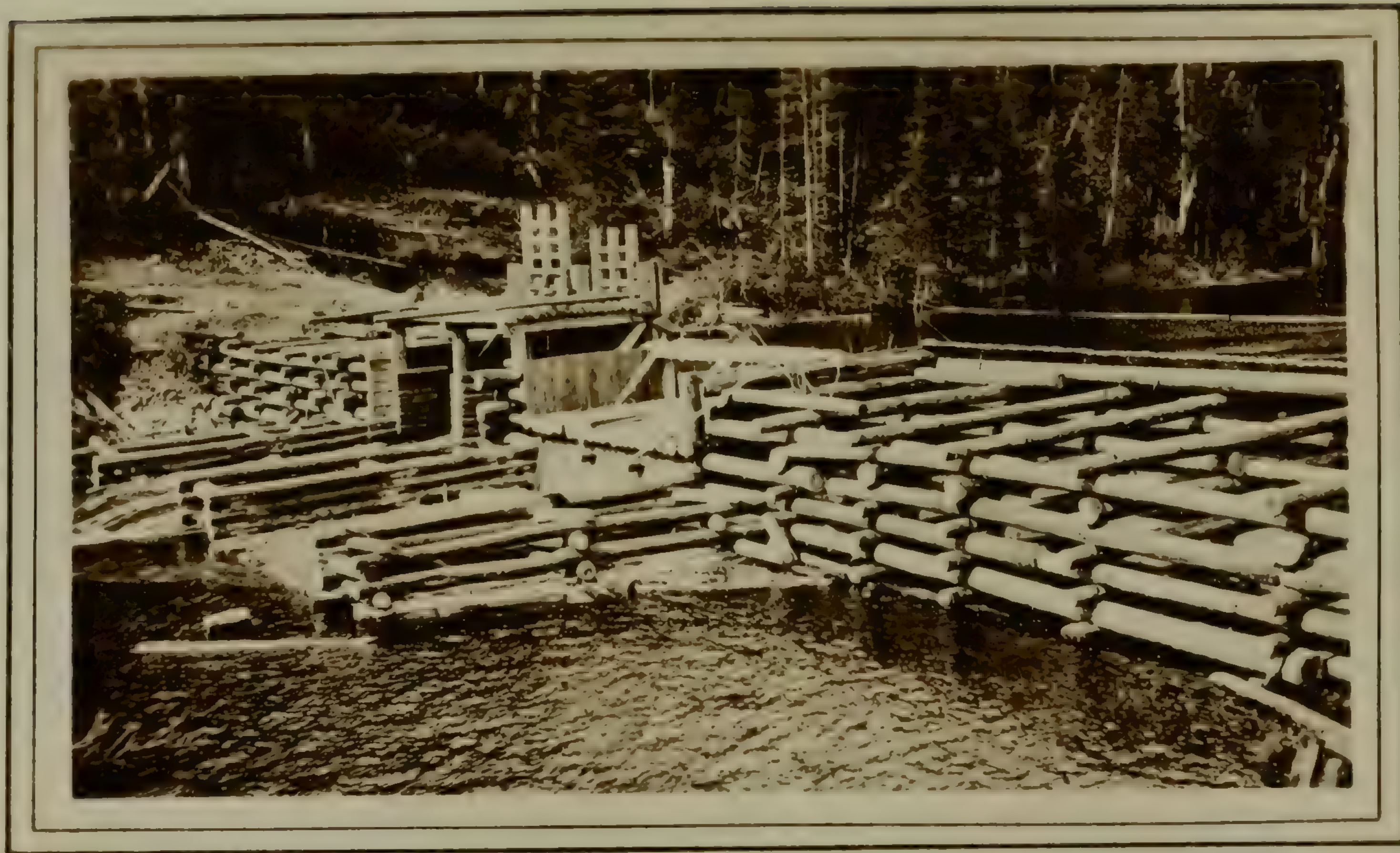
ROLL DAM.

The roll dam is used for smoothing up rough places in the stream bed.

It is constructed by laying down bed logs, flooring them over with plank or round logs, and placing loaded cribs on both sides. The main advantage of a roll dam is that it may be used in some places in place of a squirt dam at much less expense and with a saving of water.

HORSE DAM.

The horse dam is a temporary dam made to overflow certain areas for the floating off of logs, the turning of water into some particular channel, or the temporary holding of water for the running of logs over rough places in the stream. This dam is ordinarily used in low water, and is quickly and cheaply constructed with wooden horses with stringers at top and bottom, covered with spiling and gravel.



COMPANY'S DAM ON JOLIE RIVER

Construction of a Log Driving Dam For a Small Stream.

BY WM. MAHANEY.

LOCATION.

BEFORE deciding upon the proper location for a proposed driving dam, carefully examine the stream, keeping in mind the length of logs that can, or are to be driven. If long logs are to be handled it will require a dam having more head and so located that it will store more water than if only four or eight foot lengths are to be driven. The location decided upon should, if possible, be where there is either a ledge or hardpan bottom combined with such position as to give short wings and store the desired amount of water. For driving small streams and especially where short logs are to be driven a dam located so that it gives a high head, that is, a dam that will fill quickly, is preferable to one having a low head, and holding more water.

LAYING OUT OF DAM.

Having determined on the location, level across the stream to find how much head can be obtained, or if the banks are very high, locate a point on each side that will give the desired head. The distance between these points will give the length of the top of the dam. Having decided upon the width of the gate or gates, proceed to locate their position, which must be governed by the flow of the stream below the dam, but in all cases so located that the logs will readily float away from the end of the sluice.

FOUNDATIONS.

After locating and planning the dam, first excavate to a solid bottom. After this is done place logs across the stream as nearly level as practicable, the first ones to be placed at the extreme upper side of the proposed dam. Then place other logs five feet below and parallel to the first ones, (but there should be extra logs placed between the two first ones in such a position that they will come directly under the first logs of the parallel tier next above.) This process to be repeated until the desired width of the dam

has been obtained, which will be governed by the height of the dam and length of the sills. Next, place logs on this foundation at right angles to them, five feet apart and parallel to each other. At every joint or where one log crosses another, the top log must be "notched in," bored and pinned to the one underneath with ¾" refined iron pins, the usual method of building crib-work. Under these place another tier of logs across the stream. The upstream logs should not be placed over the ones in the first tier, but over the intermediate logs, which should be so placed that a line from these logs to the first ones placed will give the desired pitch, or slope to the face of the dam. This is usually at an angle of forty-five degrees or a slope of one to one. The other logs in this tier are placed directly over the ones in the bottom tier.

GATE SILLS.

Next place the sills for the gate or gates. These consist of timbers squared or hewn on three sides. Place these, unhewn sides down, across the logs forming the top tier last put in position, and at such distance apart as will give the proper width to the gate or gates. Level them up by cutting away the bottom or under side of the sills so that they will be level on top and fit solidly to the logs underneath.

WINGS.

Next construct the wings, or that part of the dam between the gates and the banks. This is done by placing logs across and lengthwise of the stream in the same manner as described in placing the bottom. One of the most important things to be done is to extend the wings a sufficient distance into the banks so as to prevent the water from washing around the ends or what is usually called "blowing." In all cases the wings should be built two feet higher than the top of the gates, so that the overflow will be over the gates. The upstream end of stringers, that is, logs placed parallel to the stream, must be adzed off so as to conform to the slope of the dam. The sides of the crib work next the gates must be timbered solid, with timber squared on three sides.

SPILING.

The wings are then ready to receive the spiling, which is the covering for the face of the dam, made of plank, when available, or what is more commonly used, small straight timber with the bark removed. One end of the spiling must rest on the solid foundation at the bottom of the stream. In placing the spiling commence at the gates or sluice way and work toward the banks. The spiling is fastened to the logs forming the cribwork of the dam by an iron pin or spike at the top and bottom of each piece and every fourth or sixth piece fastened in the center. All spaces between the spiling must be thoroughly calked. This is usually done with moss.

GATES.

While the spiling is being placed a part of the crew should be constructing and placing the gates. The gate consists of four "starts," or uprights, five by seven inches. The two outside ones must be hardwood, the other two may be of spruce. Put two by five inch mortises fourteen inches apart, through the starts. Through these mortises insert a two by five inch piece of hardwood of the same length as the width of the gate. These are called "slats." These hold the starts together and also are used to place one end of the lever under when hoisting the gate. Then spike two inch plank to the starts. The ends of the plank must be flush with the outside edges of the starts, but in all cases the gate must be two inches narrower than the distance between the bottom of the grooves which have been cut into the timbers to receive the slides. The sides being five inches thick this will give a bearing of four inches against each slide, also an inch of play on each side of the gate to prevent binding when being hoisted or lowered. Place the gates or gate directly over one of the bed pieces in the bottom to avoid rebound when the gate is dropped. Directly over this point cut a groove into timbers forming the sides of the gateway. This groove should be five inches deep and sixteen inches wide. Into the down stream side of this groove insert a hewn or sawn piece of hardwood, called a slide. This should be five by seven inches and should extend six feet above the top of the crib work. Bolt it solidly to the timbers with three ¾" bolts. This piece forms the support against which the gate rests when lowered and also when being hoisted and lowered. On the upper side the groove must be widened six inches for four feet down from the top of the crib work. Into this insert a piece of timber similar to the slide first described and extending the same distance above the crib. The object of this piece is to keep the gate in its proper place.

GRAVELLING.

Great care should be taken in gravelling the dam, for although the timber work may be perfect it will be of little use if the gravelling is imperfect. The best material for gravelling is what is known as "clay gravel," that is, gravel and clay mixed, as this when dumped into water settles quickly and the finer dirt or mud mixes with the water and is floated through the gateway, leaving an embankment resting against the spiling nearly equal to cement.

Woods Department.

RESULTS OF SHOOTING CONTEST AT THE GENERAL MANAGER'S FARM, BERLIN, N. H., NOVEMBER 25, 1914.

One Hundred Yards.

UNITED STATES

		POINTS	TOTAL
1	A. E. Rowell	5-5-4-4-4	22
2	J. F. Heck	5-4-4-4-4	21
3	P. W. Churchill	5-4-4-4-4	21
4	W. L. Bennett	5-4-4-4-4	21
5	A. L. Bowker	5-4-4-4-4	21
6	Joe Cote	5-4-4-4-4	21
7	A. Curtis	5-4-4-4-3	20
8	James Laffin	4-4-4-4-4	20
9	John Delaney	5-4-4-3-3	19
10	Ed. R. Linn	4-4-4-4-3	19
11	A. M. Carter	5-4-4-3-3	19
12	G. E. Anderson	4-4-4-3-3	18
13	F. W. Farrington	4-4-4-3-3	18
14	H. Hindle	4-4-4-3-3	18
15	S. S. Lockyer	4-4-3-3-2	16
16	Dan Horan	5-4-3-3-0	15
17	George Vaughn	5-4-3-3-0	15
18	H. B. Curran	3-3-4-4-0	14
19	Wm. Mahaney	4-3-3-2-0	12
20	F. C. King	3-3-4-0-0	10
21	F. W. Thompson	3-3-4-0-0	10
22	Fred Bailey	2-3-4-0-0	9
23	W. D. Bryant	3-4-2-0-0	9
24	P. McCrystle	0-0-0-0-4	4
25	D. W. Linton	3-0-0-0-0	3
26	Thos. Tracey	0-0-0-0-3	3
27	James Keenan	0-0-0-0-0	0

CANADA

		POINTS	TOTAL
1	C. J. Prarie	5-5-5-4-4	23
2	Fred Gilman	5-5-5-4-4	23
3	S. L. de Carteret	5-5-5-4-3	22
4	Tom Mack	5-4-4-4-4	21
5	D. P. Brown	5-4-4-4-4	21
6	James Taylor	5-4-4-4-4	21
7	J. D. Marcotte	5-5-4-4-3	21
8	C. B. Bradley	4-4-4-4-4	20
9	S. Brown	4-4-4-5-3	20
10	John Carter	3-4-4-4-3	18
11	W. J. Bignell	2-3-3-4-5	17
12	H. L. Bradbury	3-3-4-4-3	17
13	J. H. Page	5-4-4-4-0	17
14	L. C. Allaire	2-2-3-4-5	16
15	Steph. Redmond	4-4-4-3-0	15
16	Jules Cote	3-3-3-4-0	13
17	A. W. Martin	5-4-3-0-0	12
18	James Cassidy	4-4-2-0-0	10
19	R. Barbin	4-3-3-0-0	10
20	P. D. Prince	5-3-2-0-0	10
21	J. E. Robichaud	3-3-2-0-0	8
22	J. C. Corbett	0-0-0-4-3	7
23	Ralph Sawyer	0-0-0-3-3	6

Two Hundred Yards.

UNITED STATES

		POINTS	TOTAL
1	A. L. Bowker	5-4-4-3-3	19
2	P. W. Churchill	4-4-3-3-3	17
3	A. E. Rowell	4-4-3-3-2	16
4	W. L. Bennett	4-4-3-3-0	14
5	Joe Cote	4-4-3-3-0	14
6	John Delaney	3-3-2-0-0	8
7	A. Curtis	4-3-0-0-0	7
8	J. F. Heck	3-3-0-0-0	6
9	Ed. R. Linn	3-3-0-0-0	6
10	James Laffin	3-2-0-0-0	5
11	A. M. Carter	3-0-0-0-0	3

CANADA

		POINTS	TOTAL
1	S. L. de Carteret	4-4-4-3-3	18
2	D. P. Brown	3-3-3-4-4	17
3	C. J. Prarie	4-3-3-3-0	13
4	Fred Gilman	4-4-3-3-0	14
5	Thos. Mack	5-3-3-3-0	14
6	James Taylor	5-3-3-0-0	11
7	C. B. Bradley	4-3-3-0-0	10
8	J. D. Marcotte	3-2-4-0-0	9
9	S. Brown	0-0-0-0-0	0

Prize Winners.

100 Yards.

F. W. Farrington, U. S.	22
John Carter, Can.	19
G. E. Anderson, U. S.	18

200 Yards.

A. L. Bowker, U. S.	19
S. L. de Carteret, Can.	18
P. W. Churchill, U. S.	17

RIFLE CONTEST PRIZE WINNERS

A. L. BOWKER 1st

S. L. DE CARTERET 2nd

P. W. CHURCHILL 3rd

ON THE FIRING LINE

NOVEMBER 25th 1914.

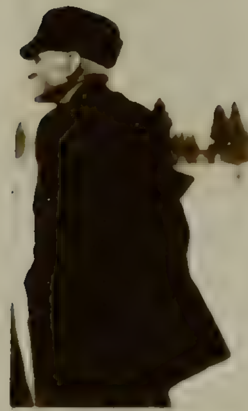
J. S. MOONEY

F.W. FARRINGTON

Ed. GIBBONS
ELLERY FORD
W. J. BRADY

D. W. LINTON
A. E. ROWELL

J. A. TAYLOR



A. M. CARTER

J. P. DELANEY

Wm. MAHANEY T. J. TRACY Wm. LAFFIN H. HINDLE

Attendance.

NAME	POSITION	COPMANY	ADDRESS
Allaire, L. C.	Local Manager	Que. & St. Maurice Ind. Co.	Moulin Beaupre, P. Q.
Anderson, G. E.	Scaler	Berlin Mills Co.	Berlin, N. H.
Bailey, Fred	Purchasing Agent	Que. & St. Maurice Ind. Co.	Berlin, N. H.
Barbin, R. J.	Bookkeeper	Que. & St. Maurice Ind. Co.	Notre Dame, du Rosaire, P. Q.
Bennett, W. L.	Bookkeeper	Que. & St. Maurice Ind. Co.	Berlin, N. H.
Bignell, W. J.	Inspector	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.
Billard, F. H.	Forester		Berlin, N. H.
Bowker, A. L.	Storehouse Manager	Berlin Mills Co.	Millsfield, N. H.
Bradbury, H. L.	Bookkeeper	Que. & St. Maurice Ind. Co.	St. Raymond, P. Q.
Bradley, C. B.	Draftsman	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.
Brady, W. J.	District Manager	Que. & St. Maurice Ind. Co.	St. George, Beauce, P. Q.
Brown, D. P.	District Manager	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.
Brown, Simmons	Purchasing Agent	Que. & St. Maurice Ind. Co.	Quebec, P. Q.
Brown, W. R.	General Manager	All Companies	Berlin, N. H.
Brockway, W. B.	Comptroller	Berlin Mills Co.	Portland, Me.
Bryant, W. D.	Bookkeeper	Berlin Mills Co.	Berlin, N. H.
Carter, H. F.	Timber Estimator	Berlin Mills Co.	Berlin, N. H.
Carter, A. M.	Timber Estimator	Berlin Mills Co.	Berlin, N. H.
Carter, J. H. Jr.	Inspector	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.
Cassidy, J. S.	Local Manager	Que. & St. Maurice Ind. Co.	Sherbrooke, P. Q.
Churchill, P. W.	General Office Manager	Berlin Mills Co.	Berlin, N. H.
Cole, Oscar F. Major,	Paymaster	Berlin Mills Co.	Berlin, N. H.
Coleman, N. H.	Surveyor	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.
Corbett, J. C.	Local Manager	Beaurivage Lumber Co.	Craigs Road, P. Q.
Cote, Joe	Farm Manager	Berlin Mills Co.	Berlin, N. H.
Cote, Jules	Notary Public		St. Come, Beauce, P. Q.
Curran, H. B.	Storehouse Manager	Fitzgerald L. & L. Co.	Johnson, Vt.
Curtis, Alphonso	Head Scaler	Berlin Mills Co.	Berlin, N. H.
De Carteret, S. L., C. E.	Local Manager	Que. & St. Maurice Ind. Co.	St. Raymond, P. Q.
Delaney, John P.	Walking Boss	Berlin Mills Co.	Berlin, N. H.
Farrington, F. W.	Scaler	Que. & St. Maurice Ind. Co.	Berlin, N. H.
Fletcher, H. B.	District Manager	Que. & St. Maurice Ind. Co.	Sherbrooke, P. Q.
Ford, Ellery	Mill Superintendent	Que. & St. Maurice Ind. Co.	St. Marie, Beauce, P. Q.
Gibbons, Ed.	Veterinary	Berlin Mills Co.	Berlin, N. H.
Gilman, Fred	River Foreman	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.
Gosselin, Jos.	Inspector	Que. & St. Maurice Ind. Co.	St. George, Beauce, P. Q.
Graff, J. H.	Official Photographer	Berlin Mills Co.	Berlin, N. H.
Gregory, H. S.	General Office Manager	Que. & St. Maurice Ind. Co.	Berlin, N. H.
Heck, J. F., B. F.	Forester	Que. & St. Maurice Ind. Co.	Berlin, N. H.
Hindle, H. H.	Walking Boss	Berlin Mills Co.	Berlin, N. H.
Hinman, B. H., Lieut.	Attorney		Berlin, N. H.
Horn, George	Walking Boss	Berlin Mills Co.	Milan, N. H.
Horan, D. J.	Inspector	Fitzgerald L. & L. Co.	Johnson, Vt.
Jutras, L. P.	Bookkeeper	Que. & St. Maurice Ind. Co.	Lyster, P. Q.
Keens, P. B.	Bookkeeper	Que. & St. Maurice Ind. Co.	Moulin Beaupre, P. Q.
Keenan, James	District Manager	Fitzgerald L. & L. Co.	Island Pond, Vt.
King, F. C.	Storehouse Manager	Berlin Mills Co.	Oquossoc, Me.
Laferriere, A. L.	Local Manager	Que. & St. Maurice Ind. Co.	Victoriaville, P. Q.
Laffin, J. E.	Storehouse Manager	Fitzgerald L. & L. Co.	Island Pond, Vt.
Laffin, Wm.	Local Manger	Berlin Mills Co.	Berlin, N. H.
Linn, Ed. R.	Forester	Berlin Mills Co.	Berlin, N. H.
Linton, D. W.	Traffic Manager	Berlin Mills Co.	Berlin, N. H.
Lockyer, S. S., F. E.	Forester	Berlin Mills Co.	Berlin, N. H.
Mack, T. E.	Purchasing Agent	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.

ATTENDANCE—*Continued*

NAME	POSITION	COMPANY	ADDRESS
Mahaney, Wm.	Head Inspector	Berlin Mills Co.	Berlin, N. H.
Martin, A. W.	Bookkeeper	Que. & St. Maurice Ind. Co.	St. George, Beauce, P. Q.
Marcotte, J. W.	Bookkeeper	Que. & St. Maurice Ind. Co.	St. George, Beauce. P. Q.
McCrystal, P.	Scaler	Que. & St. Maurice Ind. Co.	Berlin, N. H.
Mooney, J. S.	Bookkeeper	Berlin Mills Co.	Berlin, N. H.
O'Brien, Dan	Walking Boss	Berlin Mills Co.	Houghton, Me.
Page, J. H.	Head Scaler	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.
Perry, L. I.	Auditor		Boston, Mass.
Perrin, J. V.	Local Manager	Que. & St. Maurice Ind. Co.	St. Epiphane, P. Q.
Prarie, C. J.	Mill Superintendent	Que. & St. Maurice Ind. Co.	St. Raymond, P. Q.
Prince, P. J.	Head Scaler	Que. & St. Maurice Ind. Co.	St. George, Beauce, P. Q.
Redmond, S.	Inspector	Que. & St. Maurice Ind. Co.	St. George, Beauce, P. Q.
Robichaud, J. E.	Local Manager	Que. & St. Maurice Ind. Co.	Notre Dame du Rosaire, P. Q.
Rowell, A. E.	Steam Engineer	Berlin Mills Co.	Berlin, N. H.
Sawyer, R. J.	Storehouse Manager	Que. & St. Maurice Ind. Co.	LaTuque, P. Q.
Shupe, E.	Scaler	Berlin Mills Co.	Berlin, N. H.
Swan, W. F.	Bookkeeper	Berlin Mills Co.	Berlin, N. H.
Taylor, J. A.	Local Manager	Que. & St. Maurice Ind. Co.	Lyster, P. Q.
Terhune, F. M.	Auditor		New York City, N. Y.
Thompson, F. W.	Accountant	Berlin Mills Co.	Berlin, N. H.
Tracy, T. J.	Walking Boss	Berlin Mills Co.	Wentworth Location, N. H.
Vaughan, Geo. A.	Scaler	Que. & St. Maurice Ind. Co.	Berlin, N. H.

100,000 CORDS OF PEELED PULPWOOD
BURGESS MILL

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